

confidence in the wind directions as temperature indicators, but the figures show that there does exist a relation. Especially important is the fact disclosed in Table 2 that of the 32 winter temperature falls equaling or exceeding 30° during the 10-year period in question, 21 occurred following the west and southwest winds. Cold waves during winter months with temperature falls exceeding 20° occurred 123 times, and 85 of these occasions followed a westerly wind. It is also noteworthy that during the winter months 26 of the 123 temperature falls equaling or exceeding 20° followed the southeast wind, normally an indication of higher temperature. This fact was brought about by the passage of rapidly moving Lows, far in excess of normal speed, and the temperature rise as well as the subsequent cold wave occurred within the 24-hour period.

Under ordinary conditions, at Columbus, Ohio, it seems safe to consider the north, northeast, east, and southeast winds as prognostics of warmer weather 24 hours later, except in summer, when the east wind has no prognostic value; and the northwest, west, southwest, and south winds as prognostics of cooler conditions 24 hours later, except in summer, when the northwest wind is usually followed by higher temperatures. However, excepting the case of the east wind in winter, the true prognostic values are low and do not justify much reliance. Their value would be appreciable only when used in conjunction with other indications.

TABLE 1.—Showing the relation of the 7 a. m. and 7 p. m. direction of wind to the actual air temperature at those hours, and to the average subsequent 24-hour temperature changes, based on the records at Columbus, Ohio, 1909-1918, inclusive.

TO CURRENT TEMPERATURE.

Direction.	Spring.	Summer.	Autumn.	Winter.	Annual.
	° F.	° F.	° F.	° F.	° F.
North.....	44.5	63.8	46.6	23.0	44.6
Northeast.....	46.4	70.4	52.6	21.8	47.8
East.....	53.1	70.6	56.8	30.6	52.8
Southeast.....	52.2	63.6	56.2	32.8	52.5
South.....	58.7	72.5	57.7	32.5	56.4
Southwest.....	57.6	74.7	55.7	31.6	54.9
West.....	48.4	72.1	49.5	26.1	49.0
Northwest.....	41.4	66.3	47.9	23.3	44.8
Mean, seasonal.....	50.3	66.8	52.8	28.0	50.2

TO SUBSEQUENT 24-HOUR TEMPERATURE CHANGES.

North.....	+3.3	+2.2	+1.3	-0.7	+1.9
Northeast.....	+2.4	+0.4	+4.1	+5.3	+3.1
East.....	+4.4	+0.1	+3.4	+7.9	+3.9
Southeast.....	+2.6	+1.6	+1.7	+2.0	+2.0
South.....	-4.0	-0.5	-2.4	+1.1	-1.5
Southwest.....	-2.6	-4.4	-1.6	-3.4	-3.0
West.....	-2.0	-0.5	-1.8	-1.6	-1.5
Northwest.....	+1.5	+0.3	-1.1	-2.0	-0.3
Seasonal mean.....	+0.7	0	-0.4	+1.2	+0.6

TABLE 2.—Showing the number of times various wind directions were followed by positive or negative temperature changes, arranged according to the seasons, Columbus, Ohio, period 1909-1918, inclusive.

Direction.	Number times noted.	6 degrees or more.		8 degrees or more.		10 degrees or more.		15 degrees or more.		20 degrees or more.		30 degrees or more.	
		+	-	+	-	+	-	+	-	+	-	+	-
SPRING.													
North.....	235	61	15	52	9	40	2	14	0	1	0	0	0
Northeast.....	131	34	13	18	8	12	2	4	0	0	0	0	0
East.....	159	62	7	33	2	20	0	18	0	3	0	0	0
Southeast.....	253	131	62	108	48	80	44	36	30	7	7	1	1
South.....	226	41	97	30	81	19	76	13	39	4	10	0	2
Southwest.....	214	32	84	27	60	18	54	11	28	6	18	0	2
West.....	214	30	68	28	47	10	25	3	14	0	4	0	1
Northwest.....	317	78	63	62	40	53	28	20	15	3	4	0	1
SUMMER.													
North.....	235	62	28	30	13	17	6	7	1	1	0	0	0
Northeast.....	199	13	17	5	11	1	3	0	1	0	0	0	0
East.....	194	20	28	12	23	4	14	0	2	0	1	0	0
Southeast.....	229	29	17	14	10	6	4	3	1	0	0	0	0
South.....	320	25	53	19	43	11	17	6	8	1	1	0	0
Southwest.....	280	17	87	12	59	8	27	2	15	0	5	0	0
West.....	150	37	27	18	24	10	13	2	7	0	1	0	0
Northwest.....	213	20	29	13	18	6	9	2	2	0	0	0	0
AUTUMN.													
North.....	174	41	47	21	31	12	26	4	8	0	3	0	0
Northeast.....	129	46	21	26	12	19	8	11	5	3	1	2	0
East.....	200	90	21	72	7	51	5	32	1	17	0	8	0
Southeast.....	301	75	38	58	35	37	30	18	23	7	11	0	0
South.....	287	40	88	35	74	25	66	17	41	3	25	1	9
Southwest.....	245	38	68	28	59	23	42	13	31	2	18	0	5
West.....	241	24	97	21	74	17	53	7	34	3	16	0	3
Northwest.....	238	23	31	17	25	11	17	7	13	1	7	0	2
WINTER.													
North.....	156	31	44	26	28	22	13	15	7	6	3	1	0
Northeast.....	78	31	24	28	14	22	10	13	4	6	1	1	0
East.....	123	65	20	55	15	47	10	33	3	19	0	2	0
Southeast.....	275	142	72	126	57	105	48	58	36	31	26	6	3
South.....	272	108	104	82	62	63	50	29	26	14	8	1	4
Southwest.....	280	90	104	76	97	67	68	35	65	14	32	3	11
West.....	318	88	129	72	96	62	74	26	46	8	35	0	10
Northwest.....	289	37	85	26	74	16	62	6	33	0	18	0	4

THE VALUE OF HIGH-LEVEL METEOROLOGICAL DATA IN FORECASTING CHANGES OF TEMPERATURE—A CONTRIBUTION TO THE METEOROLOGY OF MOUNT ROSE, NEV.¹

By S. P. FERGUSON.

[Author's summary.]

The general relation or connection between the conditions recorded at the summit and base stations of Mount Rose appears to be practically the same as that found to exist between the summit and base stations of mountains in other parts of the world.

Of the decided falls of temperature or cold waves occurring on the summit during four years of observa-

¹ Reprinted from Technical Bulletin No. 83, University of Nevada Agricultural Experiment Station, Reno, Nev., 1915, pp. 29 and 30.

tion, about one-half were accompanied by nearly synchronous changes at the base stations; one-third were followed within 48 hours by lower minimum temperatures at the base stations; one-fifth were followed by a slight rise of temperature at the base stations.

In the instances where cold waves on the summit precede those at the base, particularly those where a rise of temperature occurs at the base, the cause is probably local gradients less steep than usual, mechanical cooling of the air at the summit during a strong wind, or clouds or fog in the valleys and below the summit. Such a condition, however, does not appear to be a very stable one and probably can not exist very long.

Abnormal falls of temperature or cold waves occur most frequently when a cyclone or area of low pressure is about 500 miles south or southeast, and an anticyclone or area of high pressure about 300 miles northwest of Mount Rose.

When well-defined cyclones and anticyclones pass over or near Mount Rose, the changes of temperature at the summit and base are nearly synchronous, for at such a time the winds at all levels are higher than normal and the atmosphere more nearly homogeneous.

It is believed that data from high-level stations will be found valuable in local forecasting when studied with reference to the prevailing meteorological conditions, as shown by the daily weather maps. However, since the processes of the free atmosphere are not as yet fully understood, particularly in this region where no systematic aerological exploration has been made, it will be necessary first to determine the vertical gradients or distribution of the chief meteorological elements by means of recording instruments elevated by kites and balloons and from observations of the formation and movements of clouds. This work should be done in some level region, such as the Carson Sink, where the phenomena of the free atmosphere are not influenced by neighboring mountains or valleys. Comparisons of free-atmosphere data with observations on mountains and in valleys under various conditions of weather will show the relation of local phenomena to the general movements of the atmosphere.

Practical use of the results of an investigation of this kind can be made by embodying the information in courses of study, and in publications, so that, in time, the residents of any community familiar with local conditions and having access to the daily weather maps will be able to make local forecasts more accurate than those based upon local or general data alone.

The writer believes that the local weather maps could be improved by the use of data from a larger number of stations and by reducing the data to the average level of the region as well as to sea level, for thereby where changes of pressure are small the effects of errors of reduction will be lessened. Further improvement could be effected by adopting the plan of the International maps wherein the pressures are published in C. G. S. units, so that the pressure at any level is a direct percentage of the entire standard atmosphere near sea level.

The Weather Bureau is rendering an important service in publishing maps, forecasts, and general information for the benefit of agriculture, and this can be made much more effective if our agricultural colleges and stations cooperate with courses of instruction and intensive investigation of problems of local interest.

AEROLOGICAL OBSERVATIONS DURING AIRPLANE FLIGHT ABOVE HAWAIIAN ISLANDS.

[Abstract of report by Lawrence H. Daingerfield, Meteorologist, Weather Bureau, Honolulu, Hawaii.]

This flight was made from Luke Field, Oahu, Hawaii, between 11 and 11:45 a. m., February 25, 1920. Readings of a sling psychrometer were made for each thousand feet during the ascent and descent, and cloud and wind conditions were also noted. Altitudes were those indicated by a standard altimeter, no corrections being applied for mean temperature of the air column.

A light westerly wind prevailed at the surface; this gave way at a low altitude to the northeast trade wind, which in turn was displaced by a strong west wind (antitrade) at an altitude of about 11,000 to 12,000 feet.

Cumulus clouds were entered at an altitude of 3,000 to 4,000 feet; above these clouds the sky was partially obscured by alto cumulus and a veil of alto stratus from the west.

Psychrometric observations were made by exposing the dry and wet bulb thermometers to the air rushing by the upper left-hand surface of the fuselage. These observations showed decreasing temperatures and relative humidities to the base of the cumulus; a continued temperature decrease and a rise in humidity from that level to the top of the cumulus; a temperature inversion and very low humidity during the next 2,000 feet; and decreasing temperatures, accompanied by increasing humidities, from about 8,000 feet to the highest altitude reached.

So far as known, these are the first free-air meteorological observations ever made above the Hawaiian Islands.—W. R. G.

ALTITUDE DETERMINATIONS BASED ON BAROMETRIC READINGS.

By H. G. CORNTHWAITE, Acting Chief Hydrographer.

[Balboa Heights, Canal Zone, Mar. 16, 1920.]

Under favorable conditions very accurate altitude determinations can be made from simultaneous barometric readings, especially in the Tropics where air-pressure fluctuations are small.

Up to elevations of 5,000 or 6,000 feet a mercurial barometer is preferable to an aneroid for this work if closely accurate results are desired; at higher levels it will probably be necessary to use an aneroid, which should give satisfactory results if the instrument used is a good one, but it should first be carefully tested covering the expected range in pressure readings. Few aneroids can be depended upon to give as accurate readings over a wide range in pressure as a good mercurial barometer. The aneroid may read accurately at sea level, but be off several hundredths of an inch at an elevation of 5,000 feet. When it is recalled that an error of 1/100 inch is equivalent to about 10 feet difference in altitude, it will be seen that an error of a few hundredths inch in the aneroid reading may mean a considerable error in the altitude determination.

A "Mountain" mercurial barometer equipped with carrying case and tripod is a convenient instrument to use for topographic reconnaissance work at moderate elevations, and it will give better results than most aneroids (see plate No. 1).